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Holocene climatic fluctuation and lithic technological change in northeastern Hokkaido (Japan)

Kazuki Morisaki [a,*], Dai Kunikita [b], Hiroyuki Sato [b]

[a] Agency for Cultural Affairs, Government of Japan, 3-2-2, Kasumigaseki, Chiyoda-ku, 100-8959 Tokyo, Japan
[b] University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, 113-0033 Tokyo, Japan

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ABSTRACT

In Japan, a body of archaeological assemblages with radiocarbon dates has been providing better understanding of relationship between lithic technology, pottery culture, settlement system, social change, and environment. This paper presented newly conducted radiocarbon dating on charred residue on potteries from Initial Jomon sites in northeastern Hokkaido. This work evidenced current pottery typological chronology and allows us to confirm diachronic lithic technological change associated with these potteries. Regarding the lithic technology, it became clear that lithic technological change into sophisticated blade technology suddenly occurred around 8400 cal BP, then lasted for very short time period until 8000 cal BP in northeastern Hokkaido, and that there was a clear technological gap between this sophisticated blade technology and the previous or subsequent simple flake technology. Since lithic raw material procurement strategy changed during this period, it is supposed that settlement system and foraging strategy might also be reorganized.

According to the correspondence between duration of the sophisticated blade technology and global climatic fluctuation, it is likely that 8.2 ka climatic event (maximum duration is roughly 8300–8050 cal BP) was responsible for this sudden change of blade technology. At present, regional environmental change driven by this global climatic fluctuation is not evidenced yet, but there is enough possibility that sudden appearance of sophisticated blade technology might have been caused not only by simple population dynamics or diffusion, but by rapid change in environmental condition.

1. Introduction

Recent progress of radiocarbon dating technology and increasing knowledge of palaeo-environment has been improving our understanding of human ecosystem (Butzer, 1982). Also in Japan, a body of archaeological assemblages with radiocarbon dates has been providing better understanding of relationship between lithic technology, pottery culture, settlement system, social change, and environment.

The final objective of our research project is also to approach, as much as possible, history of past human ecosystem from Palaeolithic to Neolithic Japanese Islands and Russian Far East. Since middle 2000s, we have accumulated radiocarbon dating on charred remain on potteries from early Neolithic sites in north Japan and Russian Far East, and continued technological analysis of lithic assemblages associating those potteries, aiming at elucidation of basic human-environment relationship.

As a preparatory step for this research, this paper shows the correlation between lithic technological changes with paleo-environmental change in Initial Jomon, early Neolithic, (11,000–7000 cal BP) of northernmost Japan (Hokkaido) on the basis of radiocarbon chronology.

Since Initial Jomon period, it is now well known that hunter-gatherers in Hokkaido started to live in pit-dwellings, utilized potteries, wooden tools, and flake lithic tools for hunting, fishing, and gathering lifeway (e.g. Okamura 1997; Nomura and Udagawa, 2001; Yamahara 2008; Tominaga 2008). However, the other assemblages, which are characterized not by flake technology and tools but by sophisticated blade technology, are also known during this period in northeastern Hokkaido. Although the existence of these assemblages was explained mainly by population migration or cultural diffusion from northern regions of Asian mainland, recent study implies it was somehow caused by climate change (Yamahara 2008).

To better understand this problem, this paper aims at clarifying the duration of each pottery type and blade industry by radiocarbon dating,

* Corresponding author at: 3-2-2, Kasumigaseki, Chiyoda-ku, 100-8959 Tokyo, Japan.
E-mail addresses: morisaki@bunka.go.jp (K. Morisaki), dkunikita@yahoo.co.jp (D. Kunikita), hsato@l.u-tokyo.ac.jp (H. Sato).

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and correlates them with the Holocene climatic fluctuation. This will show if there is relationship between lithic technology and environmental change, and the reason for the existence of sophisticated blade technology.

2. Material and methods

2.1. Pottery typology and radiocarbon dating

Materials were obtained from Initial Jomon sites in northeastern Hokkaido, which were securely excavated and have clear provenience data of artifacts including lithic tools and potteries. In particular, potteries must have charred residue on the surface for radiocarbon dating. Finally, a total of 13 sites, which are all representative in the region, were picked out according to above conditions.

The analyzed sites are located in the eastern area of Hokkaido, Japan (Fig. 1). The northeastern Hokkaido is located at the north edge of Japanese Islands, facing the Sea of Okhotsk and the Pacific Ocean. The area along the Pacific Ocean is Tokachi and Kushiro region and those along the Sea of Okhotsk is Okhotsk region. The former includes 9 sites (Tokachi District: Yachiyo A (Obihiro City Board of Education, 1990), Taisho 3, 7 (Obihiro City Board of Education, 2006), Kyoei B (Urahoro Town Board of Education, 1976), Kushiro District: Sakuragaoka 2 (Kushiro Kokogaku Kenkyukai 1987, 1988), Zaimokutyo 5 (Kushiro Kokogaku Kenkyukai 1990), Higashikushiro I (Sawa et al. 1971a, 1971b), II (Iwasaki et al. 1980), Futatsuyama 1 (Toyohara 2000a, 2000b)), the latter includes 4 sites (Abashiri District: Tokoro shell mound (University of Tokyo, Faculty of Letters, 1963), Memanbetsutoyosato (Memanbetsu Town Board of Education, 1992), Chuo A (Yonemura 1997), Monbetsu District: Yubetsuichikawa I (Yubetsu-Ichikawa research team, 2015)). Yachiyo A, Taisho 3, 7, Futatsuyama 1, Memanbetsutoyosato, Chuo A sites are respectively located in the inland area of Hokkaido.

1. Yubetsu-Ichikawa
2. Tokoro Shell Mound
3. Memanbetsu-toyosato
4. Chuo A
5. Futatsuyama 1
6. Higashikushiro I
7. Higashikushiro II
8. Sakuragaoka 2
9. Zaimokucho 5
10. Kyoei B
11. Taisho 3
12. Taisho 7
13. Yachiyo A

Fig. 1. Distribution of sites mentioned in this paper.

Potteries from these sites can be classified into 10 pottery types (and groups) by current Jomon pottery typology (e.g. Sawa 1968; Sato 1980; Nishi 1997; Kitazawa 2008; Goto and Yamahara 2008). Past thorough typological studies has sorted these types as follows from oldest to newest during Initial Jomon period; Tenneru and Akatsuki type (early Initial Jomon), Numajiri type, Higashikushiro I type > Memanbetsu type, Tokoro 14 type, Urahoro type, Yubetsuichikawa I group, and Taisho IV group (early half of late Initial Jomon) > Higashikushiro II type, Higashikushiro III type (late half of late Initial Jomon). Yubetsuichikawa I group (Investigation team of the Yubetsu-Ichikawa site 2015) is quite similar to Tokoro 14 type and Urahoro type, and could be rearranged into these types. Taisho IV group, likewise, includes Memanbetsu type and Urahoro type potteries. Though this typological difficulty should be cleared in the future, this paper considers these two group as a sort of variant of pottery types in early half of late Initial Jomon period.

Of these, radiocarbon dating analyses were conducted on 73 charred residues on pottery. Sample preparation for ^{14}C dating was done according to Yoshida et al. (2004). The concentration of the alkali treatment for the charred remains on pottery was used of a level at which the test sample did not dissolve completely. The measurements were taken using the Micro Analysis Laboratory, Tandem accelerator (MALT) at the University of Tokyo. The C/N analysis of the carbon-nitrogen isotope ratio was conducted using an IsoPrimeEA Stable Isotope Ratio Mass Spectrometer (Micromass, UK) at the Laboratory for Radiocarbon Dating in the Department of Research, University Museum, The University of Tokyo and Stable Isotope Ratio Mass Spectrometer (Thermo Fisher Scientific, Flash EA1112) at the SI Science Co., Ltd.

2.2. Lithic technological analysis

Lithic assemblages which are evidently associated with the dated potteries were carefully selected for technological analysis. Finally, 15 assemblages of 13 sites were picked out for this analysis.

We discuss lithic technology that reflects human behavioral strategies, focusing on characteristics of lithic raw material which reflects procurement strategy, and on composition of stone hunting weapons, processing tools, stone net sinker (roughly flaked pebbles) and also on primary reduction as tool blank producing technology. Primary reduction and tool assemblage indicates basic behavioral strategy of humans, and net sinkers are a marker of highly sedentary lifeway. Consequently if humans are somehow influenced by climatic change, there would be change in lithic.

Two primary reductions are recognized; flake and blade. Particularly, as for blade technology, we analyzed it in more detail, focusing on profile of blade, platform type, bulb shape.

As for stone hunting weaponry, three major types of the time period of focus can be identified; chipped arrowheads on flake (Fah) or on Blade (Bah), and bifacial points.

3. Results

3.1. Radiocarbon dating

Table 1 and Fig. 2 present the ^{14}C dates and carbon and nitrogen isotope ratios of the charred materials. We obtained dates from 8560-7040 BP for 13 sites. The Akatsuki and Tenneru type were dated to 8430-7920 BP, Numajiri type to 8560-7840 BP, Higashikushiro I type to 8410-8080

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